North Dakota Space Grant Consortium
University of North Dakota
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The North Dakota Space Grant Consortium is a Capability Enhancement Consortium funded at a base level of $430,000 for fiscal year 2011.

PROGRAM GOALS

North Dakota Space Grant stated the following goals in its FY 2011 proposal and budget:

1. Fund five research proposals worth up to a total of $50,000 from non-research affiliate institutions. Five Research Focus Areas (RFAs) have been defined (astronomy/planetary science research, planetary space suit research, Earth science research, materials science research and small satellite design and development) but meritorious, NASA-relevant projects in other areas may also be approved;
2. Fund six Summer Faculty Fellowships, each worth $5,000, that allow faculty to revise or create a NASA-relevant STEM course;
3. Provide partial or full funding for up to four North Dakota students to attend NASA Space Centers for summer internships for a total of $25,000 plus travel;
4. Provide travel funding of $10,000 to support North Dakota BalloonSat and HASP participants;
5. Provide funding for up to six FIRST Robotics teams to attend regional or national competitions for a total of $25,000;
6. Provide $2,000 in funding for travel to present pre-service workshops at affiliate colleges around the state.
7. Base funding for scholarships/fellowships will provide $130,000 to undergraduate and graduate students from across North Dakota. All

applications will be submitted through the Consortium website and evaluated for eligibility. Fellowships per semester are now $3,500 for undergraduate students, $4,500 for masters students and $6,000 for Ph.D. students and can be awarded to the same student up to two semesters. Students must submit a NASA-relevant research proposal that includes collaboration and oversight with a faculty mentor. Scholarship amounts will be determined based on recommendations of each affiliate college but it is expected that all amounts will be less than $5,000 per student.

Below is the percentage of students who have taken their next step and have been successfully tracked through their next step vs last year of Space Grant support:

100% for 2008
100% for 2009
100% for 2010
n/a for 2011- all participants still enrolled.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1, 2, OR 3)

For summer and fall semester 2011, Space Grant provided a total of fourteen (14) research fellowships and ninety-five (95) scholarships in North Dakota.

"The fellowship helped me to clarify my research goals and discover their scope of relevance and importance. It highlighted the seriousness of my undergraduate research career and was crucial to my medical school acceptance!" (Submitted by Michael Kalinoski, North Dakota State University, fellowship recipient in 2011.)

"The Space Grant scholarship has been a real blessing to me and my family. I don't have the option of a student loan and full-time work and school can take its toll. Grants like this have allowed me to spend more time on my studies and with my family." (Submitted by Palani Luger, Sitting Bull College, scholarship recipient in 2011.)

Special American Indian Scholarships of $2,500 each were awarded at each of the five tribal colleges in the state. Those scholarships are given to exceptional students who plan to transfer to a four year college in North Dakota after receiving their associate degrees at their respective tribal college.

The North Dakota Historical Society is an affiliate of Space Grant. Planning is continuing for Space Grant to be involved in developing displays for the new "Modern Era" gallery at the Heritage Center which will open in two years. Space Grant will provide expertise and funding for a display of a replica of the NDX-1 space suit developed at the University of North Dakota.

Space Grant continues to provide funding for SPACE.EDU, a masters degree program in Space Studies at UND offered on campus and via distance education. Enrollment has continued to grow and this spring the Board of Higher Education approved the Ph.D. program in Space Studies. That doctoral program will also be offered on campus and

through distance education. The investments made by Space Grant to this effort are paying off exceptionally well.

PROGRAM ACCOMPLISHMENTS

Outcome 1 programs

Undergraduate scholarships/fellowships: The NDSGC provided 95 undergraduate scholarships to our affiliate institutions. Forty (40) were given to male students and fifty-five (55) students were female. Thirty-three (33) of those students were American Indian. Any scholarship of $2,500 or more is considered to be "significant" by the NDSGC. A total of ten (10) scholarships were significant with seven (7) being given to American Indians and seven (7) being given to female students.

In addition, fourteen (14) research fellowships were given to students at the University of North Dakota and North Dakota State University. Ten (10) of those students were male and four (4) were female. None were minorities. Any fellowship of $2,500 or more is considered "significant" by the NDSGC. Eight (8) of the fellowships were significant. The six (6) fellowships not considered significant were given to students who already had partial funding for their research projects. Additional funding from Space Grant made it possible for them to complete their research. Seven (7) of those significant fellowships were given to males and one (1) to a female. Six (6) of the students were at the graduate level and eight (8) were undergraduates.

Research Focus Area (RFA) Projects: (Several of these projects were approved in FY 2010 but the research and funding continued into FY 2011.)

John Nordlie, Research Associate, UND, received funding for RFA project entitled "UAS Based Remote Sensing for Precision Agriculture." This project involved working with farmers in the region to detect changes in the agricultural fields due to damage caused by insect, fungus, water, hail, wind, etc. The project was expected to lead to operationalization of the use of small, easy to use, unmanned aerial systems by farmers so that they can collect their own remote sensing data as and when needed, without having to depend on the satellite data providers. Essentially this project aimed to put the power of collecting remote sensing information in the hands of farms themselves. Several experimental flights using CropCam, an unmanned aircraft, were conducted during the summer of 2011.

Dr. Ghodrat Karami of North Dakota State University received RFA funding to continue the design of a "Human Powered Vehicle (HPV)." The groups of students at NDSU Mechanical Engineering conducted conceptual design, implemented their design in drawings, selected materials and manufactured and assembled the vehicle. They examined and challenged the vehicle under loading and in practice. The next stage of the job was the optimization and collecting the data in practice on the vehicle in order to be able to compete at the national level. The group attended the 2011 HPV competition sponsored ASME.

Dr. Kerry Hartman of the Fort Berthold Community College, an institution tribally charted by the Three Affiliated Tribes of the Mandan, Hidasta and Arikara Nations, received RFA funding for the project "Utilizing Remote Sensing to Investigate the Surface Impacts of Oil Development on the Fort Berthold Indian Reservation." The project which involves students from the college and USGS scientists from EROS Data Center, aims to create a baseline database of information regarding the environmental impacts of surface activities of oil development on the Fort Berthold Indian Reservation.

Dr. Xiquan Dong, Professor, and Tim Logan, graduate student, UND, received funding for a RFA project entitled "Investigation of the Physical and Chemical Properties of Asian Dust and Pollution using NASA surface-satellite and DOE ARM Mobile Facility Observations in China." The research investigated the properties of Asian dust/pollution within the Asian continent. That initial Space Grant funding resulted in Dr. Dong receiving a NASA CAN award from EPSCoR for $750,000.

Dr. Ron Fevig, and Jeremy Straub, graduate student, UND received funding for the "North Dakota Inter-Institutional Space Robotics Program." The plan is to start a space robotics program that will achieve technical goals leading to a longer-term scientific mission while providing UND students and students around the state with exposure to real robotics challenges. "Mission Alpha" will consist of the design and development of an engineering prototype for a cubesat-class satellite that will be flown in the near-space environment during a statewide high-altitude balloon launch in late spring /early summer of 2012.

RFA funding was given to Dr. Mijia Yang from NDSU to study "Real Time In-Situ Impact and Damage Identification in Aerospace Materials and Structure." Polymer-matric and ceramic-matric composites have been increasingly used to aerospace structures such as the new Boeing 787 and the Airbus A380. These materials are lightweight and with high stiffness and strength. However, they are easily damaged by impact of flying objects due to their layered configuration. This proposal will develop a damage locating and growth monitoring system which will be capable of acquiring and analyzing data in real-time in-situ fashion and indicating the damage status.

Dr. Yail Kim from NDSU was given funding from Space Grant's RFA program to study "An Intelligent Composite Material System for Real-time Stress Alleviation in Aircraft Structures: Conceptual Development." Composite materials are widely accepted by the aircraft community. Despite the benefits of those new lightweight materials, composite elements need particular attention because delamination and local failure usually govern their service life. Study will be made of adequate and timely technical action to improve the longevity of structure members. A positive means to control applied stressed will be developed.

Dr. Jeff Tilly and John Nordlie, both from UND, received Space Grant funding for a research project entitled "Telemaster Flights in Preparation of NSF Proposal on Convective Initiation." This research is studying the role of the planetary boundary layer and land-atmosphere interactions on small scales in convective initiation. Previous

research has had difficulty in simulating the early stages of the convective initiation. The intention is to gather a small sample of pilot data for use in a larger proposal to the NSF.

Summer Faculty Fellowships: Seven (7) were funded during Summer 2011. Faculty were from the University of North Dakota, Dakota College at Bottineau, North Dakota State College of Science, Dickinson State University and Minot State University. A fellowship given at Dakota College at Bottineau was for the development of a lab component for Space Studies 200. That course will be broadcast from UND via IVN (Interactive Video Network) while the lab will be conducted at Dakota College. Courses developed or upgraded under this program were in the disciplines of Mechanical Engineering, Biology, Geology, Chemistry, Computer Science, Environmental Science and Space Studies.

Graduate Research Assistantship/Tuition Waivers: Space Grant funded two M.S. students in Space Studies to assist with the operations and maintenance of the UND Observatory. Both those students used data from viewing time at the UND Observatory to develop their theses. Space Grant also provided support for another student who is completing her thesis on extra-solar planets and for a third student who is using remote sensing technology on UAVs to provide timely date on field crops for farmers.

Space Grant Sponsored Travel and Research: Space Grant provided partial funding so that three Space Studies M.S. students could spend a week in the Washington, DC, area to discover and learn about different aspects of the U.S. space program. The group made visits to NASA Headquarters, the NASA Goddard Space Flight Center, the Johns Hopkins University Applied Physics Laboratory, the offices of U.S. Senators Kent Conrad and John Hoeven, and the Smithsonian Air & Space Museum. Students were exposed to a healthy dose of NASA science mission, aeronautics, education programs, space policy, and spacecraft manufacturing facilities.

Two students were funded by Space Grant to attend the launch of STS-135 and the "Un Conference" that proceeded it.

Space Grant funding was made available to the Lunabotics program, the High Altitude Student Payload (HASP) project, the North Dakota High Altitude Balloon (BallonSat) activities and the Undergraduate Student Launch Initiative. Funding was also provided for a new, exciting program called Near Space Recovery Technology. Space Grant is especially pleased to be a sponsor for this program as it involves students and faculty from Space Studies, Mechanical Engineering, Electrical Engineering and Computer Science. Support continues for the Human Spaceflight Laboratory and the Spaceflight Simulator Facility at UND.

Outcome 2 programs

NASA Space Center Internships: The NDSGC also supported six (6) students for internships at NASA Space Centers. A total of six (6) internships were funded with five (5) of them being given to males. Four (4) were graduate students and two (2) were

undergraduate students. One (1) student was a minority. All internships were considered "significant" as they were more than $2,500.

"I thoroughly enjoyed every aspect of my internship at Goddard. The Academy program did a great job pairing me with a mentor who helped me discover a passion for exoplanet research. Living with my fellow academy interns was also beneficial in that I became familiar with their lines of research as well." (Submitted by Nicole Thom, University of North Dakota, internship recipient in 2011.)

FIRST Robotics: Three teams from North Dakota high schools were supported for regional competitions in FY 2011. Those teams were from Minot, Cando and Northwood/Hatton. While none of our teams qualified for the national competition they each did very well at the regionals.

Pre-Service Workshops: Space Grant conducted pre-service workshops for 152 soon-to-be student teachers at the University of North Dakota, North Dakota State University, Mayville State University and Valley City State University.

Outcome 3 programs

North Dakota Historical Society: Space Grant is providing funding for the Heritage Center (the state's official museum) to develop educational trunks that will be available for K-8 classrooms across the state. The truck topics center on aurorae, meteorites and direct connections between North Dakota and NASA. The trunks will be stocked with objects that can be handled by students. The trucks should be ready to be sent to classrooms by the beginning of fall semester 2012. The Heritage Center has expanded this project to include stand-alone space themed displays that can be taken to conferences, shopping centers, etc. Next on the agenda for the Heritage Center and Space Grant is the development of permanent space science displays for the "Modern Era" gallery in the new addition to the Heritage Center.

Space Science Presentations to Young People: During FY 2011, Space Grant sponsored speakers (Space Studies faculty and graduate students) to numerous elementary and middle school schools in the Grand Forks school district. In addition presentations were given at the Fargo Public Library and the East Grand Forks Public Library. Space Grant was part of a special "Observe the Moon Night" at the Gateway to Science Center, an affiliate, with four graduate students supervising hands on activities for 106 children and parents. Space Grant frequently gave tours and presentations to school groups who came to UND to visit the Human Spaceflight Laboratory and the Spaceflight Simulator Facility (both of which are funded by Space Grant).

Support for High Schools: Space Grant provided $1,000 so that a team from Montpelier Public High School (enrollment of 48) could travel to a national rocketry competition. And Space grant provided $1,000 to the New Rockford-Sheyenne Public School to upgrade science labs.

Addition Public Outreach: The North Dakota Space Grant Consortium along with the EROS Data Center funded the showing of "Earth as Art Three," a collection of stunning, colored Landsat images at the Empire Arts Center in Grand Forks. The show was there for one month and was well received by the public.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Student Data and Longitudinal Tracking: Total awards = 115; Fellowship/Scholarship =109; Higher Education/Research Infrastructure = 6; 34 of the total awards represent underrepresented minority F/S funding.

  Student Data and Longitudinal Tracking: Total "significant" awards of $2500 or more= 24, Fellowships= 8, Scholarships= 10; Higher Education/Research Infrastructure= 6. During FY 2011, 8 of the total "significant" awards represented minority scholarship funding.

  During FY2011 program year 1 accepted a STEM position at a NASA contractor, 10 accepted STEM positions in industry, 1 accepted a STEM position in K-12 academia, 2 accepted STEM positions in academia and 3 went on to positions in non-STEM disciplines. The remaining students have not yet received the degrees that they were pursing while they received their Space Grant award.

- Diversity: The North Dakota Space Grant Consortium is composed of nineteen (19) affiliates. Of those affiliates, five are tribal colleges. They are Turtle Mountain Community College, Cankdeska Cikana Community College, Fort Berthold Community College, United Tribes Technical College and Sitting Bull College. All the tribal colleges are two year colleges although some of them do provide bachelors degrees in a few specialized areas. The majority of our affiliate contacts at both tribal and non-tribal colleges is female. Our records indicate that of the ninety-five (95) scholarships given last year, fifty-five (55) were awarded to female students and thirty-three (33) were awarded to American Indians. Of the fourteen (14) fellowships given, only four (4) went to females and none went to minorities.

- Minority-Serving Institutions: Five tribal colleges in North Dakota are affiliates of the North Dakota Space Grant Consortium. Each college participates in our scholarship program and has been of great assistance in finding applicants/recipients for the special American Indian Scholarships that were developed by Space Grant. Representatives from the tribal colleges are regular and contributing attendees at our annual meeting when we set priorities for the coming year. A faculty member at Fort Berthold Community College (FBCC) was the recipient of funding for a Focused Research Area from Space Grant. He and his students are using remote sensing date to study the effects of oil development on the Fort Berthold Indian Reservation. We hope that this will serve as an example to other affiliates that are non-research institutions that they too can do research that is of a practical nature and of interest to NASA and can be funded by Space Grant. Space Grant provided funding for a remote

sensing specialist to go to FBCC to give a two day work shop to Hartmann and his students on analyzing remote sensing data.

- NASA Education Priorities: College students in North Dakota were involved in hands on experiences in science and engineering through the NDX-1 and NDX-2 projects, HASP, BalloonSat, Human Powered Vehicle, Lunabotics, Near Space Recovery Project and USLI. High school students were involved in hands on experiences in science and engineering through rocketry and FIRST Robotics.

  Through the revitalization of the BalloonSat program more teachers (and students) in North Dakota are being involved in science and engineering enhancement capabilities.

  Space Grant is pleased that all five tribal colleges in the state are affiliate partners of Space Grant. Each tribal college participates at an activity level with which it feels comfortable. Space Grant is proud that it has a diversity of colleges and a diversity of faculty and student participants in its projects. (See Program Contributions in previous section.)

  Two of the Focused Research Area Projects funded this year by Space Grant involve aeronautics research. Those projects are at NDSU, an affiliate of Space Grant.

  Space Grant is attempting to involve its scholarship recipients in more active involvement in science using the Integrated Scholarships awarded at Lake Region State College as a model.

IMPROVEMENTS MADE IN THE PAST YEAR

Our annual meeting was held in May with representation from all but two affiliates. At that meeting presentations were given by the recipients of funding for Research Focus Areas. Thus the gathering became more than just a business meeting; it became a scholarship forum.

Continued emphasis was put on funding research projects beyond the UND Observatory and the Human Spaceflight Laboratory. Both the former have been very successful and so now Space Grant continues efforts to enhance, through funding, the development of ballooning and small satellite technologies and subsequent research projects.

Our BalloonSat program was revitalized by the willingness of graduate students in the Department of Space Studies at UND to serve as trackers after balloon launches. The successful BalloonSat program Space Grant sponsored for many years was forced to terminate due to lack of trackers. The enthusiasm of this new group of graduate students is making it possible for there to be multiple BalloonSat launches each year.

At Lake Region State College two of the Space Grant Scholarships were renamed Space Grant Integration Scholarships. Recipients of those scholarships are serving as lab assistants in biology and chemistry. The students expressed interest in majoring in those

sciences and so are being mentored by the professors who teach the labs. Space Grant believes this is an excellent way for students to see first-hand what might be in store for them in a science career. Space Grant plans to encourage other affiliates to provide their Space Grant scholarships recipients with a similar science experience.

One Summer Faculty Fellowship was awarded to Dakota College at Bottineau to develop a lab component for Space Studies 200 which originates at the University of North Dakota but will be broadcast to off sites by IVN (Interactive Video Network). Plans are to expand Space Studies 200 via IVN to more and more campuses in North Dakota over the coming years.

A tribal college, Fort Berthold Community College, was given Space Grant funding for a Research Focus Area project using remote sensing to study the impact of oil development on the Fort Berthold Indian Reservation. Two faculty members worked with a total of 14 undergraduate students on the project. All those students were American Indian and ten of the fourteen students were female.

Space Grant's newsletter, *The Aurora*, was published for the first time in full color. http://ndspacegrant.und.edu/uploads/aurora/aurora11.pdf

At the National Director's Meeting in Green Bay last fall, Space Grant supported the presentation of John Boucha, a research fellowship recipient, who spoke on "Developing a Space App for the iPad." At the National Director's Meeting in D.C. in March of 2012, the North Dakota Space Grant Consortium supported the presentations of two individuals from our state who received Space Grant funding. David Dvorak, a former research fellowship recipient and now CEO of a private company, spoke as did Dr. Jeremiah Neubert, advisor for the Lunabotics team at UND. That team won the national Lunabotics competition last spring at Johnson Space Center. Space Grant is pleased that we were able to receive this increased national visibility for our program from our colleagues in other states.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The Space Grant affiliate members in North Dakota helped develop our strategic plan. Throughout the academic year, affiliate members provide input as to what degree of involvement the respective colleges and universities will have in various projects. An annual meeting of all affiliate representatives is held each spring; at that time discussion is held as to possible new projects and programs that could be sponsored by Space Grant.

Institutions that comprise the North Dakota Space Grant Consortium include the following:

Bismarck State College—two year community college
Cankdeska Cikana Community College—tribal college at Spirit Lake Indian Reservation
Dakota College at Bottineau—two year community college
Dickinson State University—public four year college

Fort Berthold Community College—tribal college at Fort Berthold Indian Reservation
Gateway to Science Center—children's science museum in Bismarck
Grand Forks Herald—regional, daily newspaper
Lake Region State College—two year community college
Mayville State University—public four year college
Minot State University—public four year college
North Dakota Heritage Center—state history museum in Bismarck
North Dakota State College of Science—two year technical college in Wahpeton
North Dakota State University—doctoral research university in Fargo
Sitting Bull College—tribal college at Standing Rock Indian Reservation
Turtle Mountain Community College—tribal college at Turtle Mountain Indian Reservation
United Tribes Technical College—tribal college in Bismarck supported by all four Indian Reservations in the state
University of North Dakota—doctoral research institution in Grand Forks
Valley City State University—public four year college
Williston State College—two year community college